A POINT OF VIEW IN THE TEACHING OF ELECTRICITY IN THE UNIVERSITY ELEMENTARY SCHOOL

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One of the much-discussed questions in the teachers' world today is "waste in education." All agree that there is a waste, but there is no unanimity of opinion as to just what constitutes the waste, and therefore suggestions of reform are legion. I do not intend to advocate a certain group of studies, the omitting of some or the adding of others, although it seems that our curricula need some revisions; but I wish simply to repeat the old suggestion that it is not the subject-matter which educates, but the mental effort consciously directed to the utilization, and hence organization, of that subject-matter. We do not educate the child; we help the child to educate himself. In our problem of teaching him to think, we wish him to use those means which will insure the best results in the shortest time. We all recognize *interest* as one of the great impelling factors in developing one's self; for genuine interest implies purpose and urges the application of all the faculties to the problem. Interest begets motive, and the motive guides the child. Both interest and motive profit from their being so closely related. Transient, shallow curiosity must not be confounded with genuine, lasting, deep interest. The point of view is that the impelling force must come from the child, not the teacher.

It may be only a result of tradition, and the modern school not at fault, that upon entering the school building many children feel that they must abandon all they really like to do. Where manual-training shops are introduced, and the boy feels that at last there is one study in which he may put something of himself, his hopes are often crushed by his being set at work making models "to learn technique." His own motive has been taken

away; his guiding principle is gone. But if the piece of work which he wishes to do is so difficult that he cannot do it until he has learned the necessary technique for that piece of work, he attacks the preliminary work eagerly. The manual-training shop is a place where obviously the interests of the child may give a great interest and direction to the work; but I believe that the other studies also can be so organized about the interests of the class that there will be a distinct gain in the educational efficiency.

It is strange that it is in the teaching of science in the elementary school that the child's natural interests are most ignored. Children begin the study of nature and science with interest. But when they are led into formal abstractions about nature before they have any material upon which to generalize, the interest wanes. Where there is such a wealth of material which the children are eager to use, if guided and encouraged, it is too bad that the results are so poor. Perhaps it is the very wealth of material which confuses teachers. Without the organizing and unifying motive in the child by which the newly discovered facts may be related, it is difficult to get order out of the mass.

One of the lively interests of boys of twelve and thirteen is in electricity. If they receive the slightest encouragement at home, they attempt to repair the electric bell or recharge the cells, and will go to infinite trouble to learn how. They attempt to make bits of electrical apparatus, usually with failure, but this only increases their interest. When the course in electricity was introduced into the curriculum of the seventh grade, two years ago, an effort was made to let it consist of experiments along the lines of the interests of the class — experiments mostly suggested and devised by the children themselves toward the solution of their own problems. Naturally only the simplest apparatus was used, because the children knew of no other. They made most of the apparatus themselves.

The first two- or three-lesson periods were given to a report of what they had attempted at home, what difficulties they had encountered, and what they wished to know about electricity. Many had a real interest in electrical apparatus and machinery, and were willing to work hard to learn more. In the preliminary

discussions they found that nearly all the electrical machines with which they were familiar embodied the principles of magnets. Our first work was therefore with magnets. I did not have to put the questions; for the class in the discussions asked many. These questions were organized in class as a basis for the laboratory exercises. The children used their own magnets largely in the laboratory experiments, and this was encouraged. Of course, many could answer most of the questions without having to experiment; they advanced to other work. No attempt was made to keep the class together in the experiments, but a strong class unity was noticeable in the frequent "report" lessons. Each child contributed something to the whole.

The work with electro-magnets was preceded by several hours' work with the electric current. As before, the apparatus was of the crudest — ordinary thick-walled drinking-glasses, small strips of zinc and copper from the tinsmith's, copper wire, and dilute sulphuric acid. In these experiments the problems expanded as the work continued: the proofs of a current, the bubbles being given off, the origin of the electric current, the expense at which it was being generated, the circuit, amalgamating the zincs, adding something to the acid to remove the annoying hydrogen bubbles, and ways of increasing the current by joining cells. These cells were, of course, very inefficient, and even when modified did not offer a convenient source of electricity for later experiments; but they had served their purpose. For later work we used the current of storage cells, or of ordinary wet cells belonging to the school equipment. The discovery of the effect of an electric current upon a magnetic needle suggested a convenient "current detector." Each child made one for use in future work.

It is not necessary to describe all the work in as much detail as is given above. It is sufficient to say that by following the same plan of letting the class organize the questions through discussion, and expecting individuals or groups to organize ways and means of answering these questions experimentally, we not only covered considerable subject-matter in the twelve weeks, but encouraged considerable mental activity toward definite ends. The class really thought to a purpose.

The experiments with the simple electric cells were followed by experiments with electro-magnets (nails, iron and steel rods wound temporarily with insulated wire), and with two of the common electro-magnetic machines — the electric bell and the telegraph sounder. We considered motors and telephones too complex for the class as a whole. Each person made a miniature electric heater, and did enough of copper-plating to understand the principle.

Last year the class set up an electric gong in the school, laying the wires and making the connections themselves, expended the circuits of the signal buzzers to other rooms; and several learned to operate and adjust the electric stereopticon. The interest extended back into the home, and there a majority of the boys set up telegraph instruments from house to house or from room to room, and learned the code, or put up elctric bells and buzzers, or wound motors; and one boy constructed a telephone.